of water would at all times be effectual in removing soil, and preventing depositions of all kinds: this, it is clear, could only be done by causing them to bear a proper ratio to the roofage, and the size of tubes through which water is conveyed to the house from which the drain is to be led. Now if, as is almost always the case, the water-pipe of an establishment leading from the main be only half an inch, or say an inch, it struck me that there could be no necessity for a construction of one foot, one foot and a half, two, and even three feet calibre to conduct this water, with its accompaniments, from the house into the common channel, or main street sewer; it having merely acquired the addition of soil." The rule deducible from these remarks, by which the size of house drains may be calculated, is simple. "To the calibre necessary to carry off the water laid on, add that required for the reception of the rain or surface water—this latter may be readily calculated from the indications of the rain-gauge of the locality;" or from the quantity assumed to be derived from a roof of a given surface, as we have before noticed. For moderate-sized houses, say of eight rooms, and holding some five or six persons on an average, a tube of five inches in diameter will suffice for the house drain. A six-inch pipe laid with a sufficient fall will be ample, if properly treated, for the most capacious private house. Having, then, ascertained the size, the next step will be to decide on its form and material. With reference to the shape or form of the drain, it is now universally admitted that the circular, or, if comparatively large, the elliptical or oviform, is decidedly the best. As to the material, the two points to be obtained in such are, "impermeability, and smoothness of internal surface." These, it is evident, cannot be easily obtained, if at all, by the use of bricks or other similar material. The earthenware tubes, now so largely used, offer the required advantages: they are tolerably cheap, easily laid down, and, by being glazed in the interior, as some kinds are, little or no resistance is offered to the passing fluid; they are, moreover, kept clean for a considerable time, the soil refusing to adhere to the polished interior. The depth at which the drains are to be laid is the next important matter to be considered. There are various opinions on this point: the construction of many houses, having deep basement stories, necessitates, in the opinion of some, the laying of the drains at a considerable depth beneath the surface of the ground. The more thoroughly the principle of having the drains at or near the surface of the ground is carried out, the more efficient and certain will be the operation of the drains. It will certainly be objected to this plan, that many, if not all, basement buildings must remain undrained; but even in such cases "it will be still equally imperative that all the sewage water shall be delivered into the drain at or near the ground level. No sink or other apparatus for discharging refuse water should be retained in the basement, and the extra labour of carrying this water up to the surface level, or head of the drainage, must be incurred as the penalty of this misconstruction or misappropriation of the building."

In laying down drains, the arrangement first to be looked to after the size and depth are arranged, is the collecting of the drainage matter to one point. Thus the products of the water-closet and sink should be led at once to a trapped contrivance by which it will be readily admitted to the drain leading to the sewer, yet all gaseous matter therefrom prevented from ascending through it to the house, or surrounding atmosphere. This is an essential point which ought not to be overlooked. The contrivances for attaining this are so numerous, cheap, and effective, that there is and ought to be no excuse made for neglecting it. As the Commissioners of Sewers in the metropolis consider the joining of the house drain with the main sewer a matter of such importance that they make it imperative upon house owners to hand over this part of the construction of drains to their own officers; it is needless for us here to enter into a detail of the methods adopted. In laying drains it must be recollected that all angular and sudden bends must be avoided: these are very prejudicial to the speedy carrying off of the products. When curves are essentially requisite they ought to be of the largest possible radius. All joints ought to be carefully luted, so as to render the whole length of the drain perfectly impermeable.

In connecting water-closets with drains, the point of discharge from the same should be as close as possible to the main sewer into which the drain empties itself: the matter from the closet being certain to be more solid than liquid—the sewage water will have more removing force at a point further away from the place where it enters the drain than near to it. The farther, then, the water-closet is from the place where the greater portion of the sewage water enters the drain, the more certain will the removal of the solid matter be. The water from the kitchen-sink, and from the fixed wash-hand basins (if any) in the bed and dressing rooms, should, if possible, be admitted to the trap basin of the water-closet: these will act efficiently in removing the solid matter therefrom. Cesspools, those defective contrivances before alluded to, should never be made in new buildings. In cases where they unfortunately are in use, more especially where a privy is attached to them, the entrances should be carefully trapped so that the offensive odour can have no means of access to the house. A drain should be led from a part of the cesspool, at a certain height, to the drain leading to the sewer, so that the superabundant material in the cesspool will at once be drawn away, and the matter therein consequently kept at the same level. A trap basin should always be adapted to a cesspool privy—the syphon form is cheap and effective. The refuse water from domestic purposes may be thrown into this, which will aid in carrying off the solid matter. The wisest plan, however, is to fill up or build carefully over, all cesspools wherever situated, substituting for them efficient well-drained water-closets. An important desideratum in effective drainage is a ready means of access to the drains, by which they may be examined and cleaned when necessary. If the tubes are placed in any thing like straight lines, this operation will be much facilitated. Moveable covers, placed at the angles or turnings, through which a simple apparatus might be inserted for removing matter from the interior of the drains, have been suggested. The plan seems good, but would it not be a matter of difficulty in getting the parties performing the duty to replace carefully these covers? If so, the cure would be infinitely worse than the disease. If the drains are properly proportioned, according to the matter they have to convey, and composed of proper materials smooth in the inside, we apprehend there will be little necessity for mechanically cleansing them.

So much has of late been written about the importance of *ventilation*, that all remarks appear trite and common place. They are nevertheless disregarded. All are agreed as to the necessity of having a good supply of air in the interior of our houses; nevertheless, people are by no means unanimous in their endeavour to attain such by the adoption of constructive contrivances or arrangements connected therewith.

The most simple and efficient mode of ventilating is by taking advantage of the natural currents which are created and maintained by the movements of heated air. Air when used for the purposes of respiration, after being expelled from the lungs, is raised in temperature to such a degree, that it rises immediately upwards. Some practitioners advocate the mode of ventilating by withdrawing the used air by the bottom of the apartment, as, say they, the carbonic acid gas, composing by far the largest portion of respired air, being a heavier gas than common air, must perforce descend to the ground. This goes directly counter to the facts so clearly elucidated by Dalton, in his theory of the diffusion of gases. From his experiments, which were thoroughly conclusive, and which have been corroborated by those of others, more especially by Professor Graham, the fact was clearly established, that "all gases tend to diffuse themselves through each other even when no chemical combination ensues." Light gases and heavy gases mix freely with one another in *opposition* to their natural gravities. "Light gases even descend, and heavy gases ascend." Dalton accounted for this phenomenon by assuming that gases diffuse themselves through each other in the same way as they would pass into a vacuum. Thus, "in consequence of this power of diffusion, no gases can ever remain for any length of time at the surface of the earth, however heavy. The poisonous carbonic acid evolved by respiration, combustion, and numerous other natural operations, steals insensibly into the superincumbent air, and has been detected at the greatest altitude which man has hitherto attained."

We are by no means disposed to look upon ventilation as a matter of difficult attainment: we consider that the laws which regulate the movements of air are simple, and can as simply be made available for practical purposes. To maintain a healthy ventilation of the lungs in the open air is easy enough: the nearer we can make our houses approach to the condition of the external air, the more perfect will they be with reference to their health-maintaining powers. In carrying out simple plans to attain this, various modifications must necessarily be introduced to be made subservient to our ideas of comfort, whether these ideas are or are not consistent with reason and sound scientific views. Thus, it is an easy matter to give to any room an unlimited supply of fresh air, but unfortunately it is not such an easy matter to warm that air so as to make it comfortable in its effect, and to deprive it of that power which it undoubtedly has when injudiciously admitted, of inducing colds and other complaints. Still, we hold, it would be a libel on the mechanical genius of the day, to say that simple, effective, and cheap means of heating air cannot be introduced. Thus, there is much heat actually lost—thrown up the chimney, or communicated uselessly to surrounding materials in every fireplace,—which could be simply and cheaply used for affording heat to a simple contrivance placed opposite the fresh air aperture. It may be said that more fuel would thus be consumed: little or none; but if it were the case, it is all got back again, and with double effect—it serves to warm effectually the air of the room, and what is coal consumed for if not for this? A small supply of hot water will be sufficient to heat the admitted air used for ventilation, by the application of a simple contrivance to the fires used in a house, by which most of the heat now lost would be made available for the very purpose for which coal is consumed. The water thus obtained could be led to places where requisite, and made useful as a heating power by being placed in a series of small pipes, or a "heating box." There would be no trouble attendant on the plan: once set in operation, it might continue for months untended. We do not despair of seeing gas applied to effective heating apparatus: it is admirably adapted for dwelling-houses. In making apertures for the admission of fresh air, the builder need not be apprehensive of making them too large or too numerous—the more area he can get the better. In the open air, although surrounded by an ocean of air, we do not take more than our lungs require; and so in like manner in our houses, if the supply be ample, more than in fact is required, it will do no harm—the supply of air through the apertures will, in truth, depend upon the demand for it in the interior.

For withdrawing the foul air, various plans have been put in requisition: the chimney is a good ventilator, but its powers of usefulness are restricted by the facility with which smoke is driven down the apertures. Many contrivances are made to obviate this, but they are not altogether faultless, and should be looked upon at the best as mere make-shifts, or substitutes for better plans. Flues may be conducted up the interior of the walls, made with smooth circular tubes, having their upper apertures beneath the cornice or eaves, and the lower one at the cornice in the apartment to be ventilated. The most efficient plan would be the carrying up of independent flues alongside of the chimney-flue, the heat of which would increase the temperature of the vitiated air in the ventilating flue, and consequently its ascending force. Such an independent flue would act in most seasons, but in winter, from the chimney-flue being heated by the products of the fire, the power would be greater, and it would act with more certainty. At the aperture in the room, communicating with the interior of the ventilating flue, a gas jet might be lit in summer time which would act efficiently as an exhausting power. The

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